non-modified layer (non-modified portion) 204a being both ends (top layer and bottom layer) in the film thickness direction of the polymethyl siloxane film, almost of which has been not modified by the electron beam.

Next, a plurality of wiring grooves 205 (205a, 205b) are formed on the surface of the second interlayer insulation film 204 by means of etching using a CF based gas, for example. The diameter of the wiring groove 205 is about 0.175 micron, for example.

At this time, the plurality of wiring grooves 205 are set so that their deepest part (bottom part) penetrates a portion of the non-modified layer 204a that is an upper layer of the second interlayer insulation film 204, and reaches the modified layer 204b, or alternatively, their deepest part penetrates the modified layer 204b.

When a difference (deviation) in depth between a plurality of wiring groove 205 is investigated, the wiring groove 205b on the marginal part of the semiconductor substrate 201 is slightly deeper by about 5% than the wiring groove 205a on the center of the semiconductor substrate 201. That is, almost no deviation is observed between the wiring groove 205a and the wiring groove 205b. The above value (deviation value) is half of the deviation value (10%) of the wiring grooves formed on the surface of the polymethyl

siloxane film (conventional) formed without a vanish being irradiated with the electron beam.

The above error of about 5% in processing dimensions is within an allowable tolerance that can be ignored to maintain at practically proper level the performance of a semiconductor device 206 comprising a polymethyl siloxane film as a second interlayer insulation film 204, the semiconductor device containing wires (not shown) provided at the second interlayer insulation film 204.

In this way, in the polymethyl siloxane film formed by the method of the present embodiment, an etching rate at its marginal part is slightly higher than that of the center by about 5%.

This is because the etching rate of the modified layer 204b is smaller than that of the non-modified layer 204a, and a difference (deviation) in etching rate along the film thickness direction at the marginal part and center part of the second interlayer insulation film 204 is adjusted (corrected) so as to be substantially uniform.

According to experiments made by the Inventor et al, the etching rate of the polymethyl siloxane film (conventional) formed without irradiating a vanish with the electron beam is about 300 nm per minute. On the other hand, the etching rate of the polymethyl siloxane film formed by the method of the present embodiment is

about 100 nm per minute. The etching rate of a portion (non-modified layer 204a) other than the modified layer 204b of the polymethyl siloxane film is about 300 nm per minute in the same way as conventionally. In the above experiment, a CF based gas is used as an etching gas.

Therefore, in the polymethyl siloxane film formed by the method of the present embodiment, it is considered that the in-plane deviation of etching rates produced in the non-modified layer 204a having its comparatively high etching rate of about 300 nm per minute is adjusted in the modified layer 204b having its comparatively low etching rate of about 100 nm per minutes, whereby a difference (deviation) in depth of the finally formed wiring grooves 205a and 205b has been reduced.

In addition, according to experiments made by the Inventor et al, even in the case of using an insulation film other than polymethyl siloxane film, as in the step of forming the second interlayer insulation film 204, it is found that the insulation film is formed together with the heating work and the electron beam irradiation work, whereby a part of the above insulation film can be formed to be modified.

Further, by carrying out the heating work and the electron beam irradiation work in combination, as described in another example, it is found that there